

Phase II

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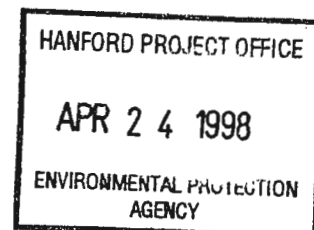
**PLAN OF ACTION TO RESOLVE
SPENT NUCLEAR FUEL
VULNERABILITIES**

PHASE II



APRIL 1994

U.S. Department of Energy



PLAN OF ACTION TO RESOLVE SPENT NUCLEAR FUEL VULNERABILITIES PHASE II

I. Executive Summary

A. Purpose and Contents of Phase II Plan of Action

This Phase II Plan of Action, like the original Phase I Plan of Action, provides information in response to the *Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel and other Reactor Irradiated Nuclear Materials and Their Environmental, Safety, and Health Vulnerabilities*, which was presented to Secretary of Energy Hazel O'Leary and released to the public on December 7, 1993. That report, which was the result of an assessment by the multi-discipline Spent Fuel Working Group directed by the Assistant Secretary for Environment, Safety, and Health, identified a total of 105 vulnerabilities associated with the Department's spent nuclear fuel storage facilities. (After the report was released, another vulnerability was identified, bringing the total to 106.)

In all, the Plan of Action consists of a consolidation of individual action plans designed to address each of the individual spent nuclear fuel vulnerabilities in a manner that reflects the Department of Energy's

- sense of urgency;
- concern for worker protection;
- commitment to mitigate environmental impacts; and
- need for compatible long-term solutions.

Actions are underway at all sites to address the vulnerabilities as efficiently as possible. Unresolved funding, policy, and technical issues existed that prevented final development of all action plans simultaneously; therefore, the complete Plan of Action is being developed and issued in three phases. Phase I was released on February 7, 1994; this report, Phase II, represents an update of the Phase I Plan of Action. Phase III will be released in September 1994.

Phase I - The Phase I Plan of Action included those facility action plans for which no major outstanding policy or funding issues existed. For the 106 vulnerabilities identified, the Phase I submittal addressed 31 of 33 high-priority vulnerabilities and 48 lower-priority issues.

Phase II - This Phase II Plan of Action is the product of follow-on work to the Phase I report. During the weeks since the Phase I report was issued, the Department has resolved a majority of the funding issues associated with spent fuel vulnerabilities. This update includes those individual action plans that have been developed based on resolution of the funding issues.

Phase III - The Phase III Plan of Action, the second update to the original Plan of Action, will be issued in September 1994. This report will focus on the resolution of critical policy issues. The Phase III report will incorporate stakeholder comments on the original Plan of Action and the first update.

Stakeholder comments related directly to the Phase I Plan of Action primarily addressed the categorization of the vulnerabilities and the time schedule of the corresponding corrective actions. To the extent possible, these comments have been taken into account in developing and updating the Phase II individual action plans and will continue to be considered when developing Phase III. Broader programmatic concerns were expressed regarding such issues as the need for a decision on the final disposition of DOE-owned spent nuclear fuel, and the ways in which stakeholders will be involved in DOE's decision-making process regarding the overall spent nuclear fuel program. These broad policy concerns will be carefully considered when developing the Phase III Plan of Action.

B. Updated Information Provided in the Phase II Plan of Action

This Phase II Plan of Action contains revised information on vulnerabilities addressed in the Phase I Plan of Action. Some facility action plans have been revised, while others are completely new. This updated information reflects the fact that a majority of funding issues existing at the time of the Phase I report have been resolved. Funding for activities to be completed in FY 1994 currently exists. Funding for FY 1995 activities is reflected in the budgetary request currently going through the approval process. Funding for FY 1996 and later years, although expected to be approved, is subject to the normal Federal budgetary process. In Phase II, finalized individual action plans for the 106 vulnerabilities have increased from 44 (Phase I) to 81. The number of partial actions now stands at 25. This means that all vulnerabilities are now addressed by either a complete or partial individual plan. The completion of the partial action plans will be addressed in Phase III.

As of the Phase II Plan of Action, the majority of funding requirements for the next three fiscal years have been (or will be) taken into account when formulating the appropriation budgetary request. Many funding issues that were far from resolution at the time of the Phase I Plan of Action are now settled. For instance, actions at the Oak Ridge Solid Waste Storage Areas are now fully funded, and actions at Pacific Northwest Laboratory Buildings 324, 325, and 327 have gone from essentially no funding (as of Phase I) to a significant level of funding.

Individual corrective actions to resolve vulnerabilities are discussed in Section IV, and the text has been revised based on the analogous section in the Phase I Report. The tables in Appendix A and B, which contain Action Plans for the major vulnerabilities and for those to be addressed in less than one year, have been updated to reflect the Section IV modifications. Vertical lines in the margin are used to indicate where substantive portions of text were changed or added in Sections I through IV. Margin lines have not been used in the tables to indicate the changed portions. As in the Phase I report, some individual plans provided in the appendices are incomplete because of unresolved issues.

Appendix C of the Phase II Plan of Action contains action plans for those facilities that were not addressed in Phase I, as well as action plans for vulnerabilities that were not addressed in Phase I even though their associated facilities were discussed with respect to other vulnerabilities.

Appendix D contains an update of information previously provided in Phase I, which is a listing of the entire 106 vulnerabilities and identifies both the priority (eight priority facilities, action less than one year, and action greater than one year) and the current status of the development of the individual action plans (complete or partial).

Activities in Progress that Address Identified Vulnerabilities

In the Executive Summary (Volume I) of the Phase I report, there was a discussion of activities already underway to address identified vulnerabilities. In order to update that information, provided below is a summary of the more significant activities currently in progress or that will commence prior to the issuance of the Phase III report. This summary reflects DOE's ongoing commitment to address the identified vulnerabilities in an expeditious manner.

Hanford

- Activities are underway to support pilot encapsulation of K-East Basin fuel in MKII canisters, which was scheduled to start in June 1994. A revised fuel encapsulation schedule for the pilot run will be issued by Westinghouse Hanford Company to DOE-RL by May 2, 1994 and may result in a delay. The central reasons for this potential delay are related to technical uncertainties of fuel condition and integrity and to the effectiveness of encapsulation procedure and equipment. Additional reasons for the potential delay are conduct of operations issues resulting from facility plant readiness process and revisions to the readiness review process in conducting a WHC and DOE Operational Readiness Review.

Provisions have been made to increase the basin water level to provide additional radiation shielding in conjunction with pilot encapsulation. Installation of construction joint protection was completed on April 11, 1994.

- Fabrication and installation of an additional cofferdam in the K-West Basin is scheduled to be completed in June 1994. This will reduce the possibility of a seismically induced leak at K-West and verify the installation procedure that will be used at K-East if needed.

Idaho

- A number of activities are underway at the CPP-603 Underwater Storage Facility to reduce the impact of corroded spent fuel and minimize the release of fissile material to the basin.
 - The failed System for Nuclear Auxiliary Power (SNAP) fuel containers will be replaced with stainless steel overpacks. This is scheduled for completion in July 1994.
 - Accessible sludge will be removed in order to help maintain water clarity and to reduce release of radionuclides into the storage basin. This activity is scheduled to be completed in June 1994.

- Video inspections of aluminum materials at the Materials Test Reactor Canal to monitor corrosion will commence in May 1994. Similar inspections at the Power Burst Facility are scheduled for September 1994.
- An evaluation has been completed regarding potential safety consequences associated with the CPP-666 basin pool gates. It was determined that no mitigating actions are required for the present configuration.

Savannah River

- Assessment activities are underway to determine soil stability for input to seismic analyses. K-Reactor Basin analyses are underway; L and P Reactor Basin analyses will start in the near term, as determined by the Basis for Interim Operation documentation, and will be completed by September 1994.

Oak Ridge National Laboratory

- A surveillance program has been established to detect the presence of water in empty storage wells in the vicinity of Solid Waste Storage Area 5.
- Efforts have been completed to determine the burial location of two shipments containing enriched fuel; the resulting information has been provided to the environmental restoration program.
- Field surveys have been completed to locate and mark the Homogeneous Reactor Experiment (HRE) disposal wells. Based on this information, site characterization activities are underway.

West Valley Demonstration Project

- The ability to monitor water chemistry in the fuel pool is being improved as a means to ensure water purity and maintain structural integrity of the fuel assemblies. By June 1994, in-line pH and conductivity measurement capability will be installed to support needed chemistry data trending.
- To help improve water quality in the fuel pool, installation and startup of the Submerged Water Filtration and Demineralization System will be completed by June 1994.

Los Alamos National Laboratory

- Activities are underway to support transfer of all fuel at the Omega West Reactor (OWR) to the Chemistry and Metallurgy Reactor (CMR) building to eliminate potential criticality safety problems and to address seismic concerns.

Argonne National Laboratory West

- The uranium fuel at the Zero Power Physics Reactor (ZPPR) has been re-encapsulated in sealed inert canisters.
- The project to replace the in-ground storage liners at the Radioactive Scrap and Waste Facility (RSWF) is continuing.

II. Introduction

A. Background

In August of 1993, Secretary O'Leary commissioned a comprehensive baseline assessment of the environmental, safety, and health (ES&H) vulnerabilities associated with the storage of spent nuclear fuel (SNF) in the DOE complex. During October 1993, a multi-discipline Spent Fuel Working Group, comprised of DOE employees and contractors, assessed 66 facilities spread across 11 sites. This assessment was performed to determine the inventory and the condition of the Department's Reactor Irradiated Nuclear Material (RINM) which includes spent nuclear fuel and reactor irradiated target material. The assessment also evaluated the condition of the facilities that store spent fuel and identified the vulnerabilities and problems that are currently associated with these facilities.

This assessment was performed under the direction of the Department's Office of Environment, Safety, and Health, with participation by the DOE Operations Offices, National Laboratories, the site management and operating contractors, and personnel from various DOE Program Offices and contractors. These organizations designated personnel with the best technical knowledge of the inventory data as well as an understanding of the operations and underlying safety bases for the storage facilities to form the Spent Fuel Working Group. The Working Group then planned, coordinated, collected, validated, evaluated, and characterized the material inventory and identified ES&H vulnerabilities.

Based on this evaluation process, a report to the Secretary, entitled Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel and Other Reactor Irradiated Nuclear Materials and Their Environmental, Safety and Health Vulnerabilities ("The Working Group Report," Volumes I, II, and III), was released to the public on December 7, 1993. Hereafter in this Plan of Action, Volume I of this report will be referred to as the "Summary Report."

B. Scope of the Problem -- Overall Plan of Action

The Working Group Report released in December 1993 identified a total of 105 vulnerabilities associated with the Department's Spent Nuclear Fuel storage facilities. Subsequent to issuance of the report, a potential vulnerability was identified related to buried fuel at the Savannah River Site, bringing the total number of vulnerabilities to 106. Eight facilities with major vulnerabilities were identified in the Summary Report, for which priority management attention was recommended. Volume II of the Working Group Report categorized all other identified vulnerabilities based on the time frame during which it was recommended that the vulnerability be addressed. In addition to the eight priority facilities, the vulnerabilities were grouped into one of three categories where management attention should be directed: less than one year, one to five years, and greater than five years.

An effort has been underway since issuance of the Working Group Report to develop a finalized Plan of Action to address all vulnerabilities, taking into consideration currently available resources for implementation. This effort was also designed to determine which issues existed that might delay near term formulation of a definitive Plan of Action to resolve the identified

vulnerabilities. It was determined that substantial unresolved issues exist in the areas of funding availability, critical policy decisions, and technology development. Accordingly, it was decided that the overall Plan of Action would be updated twice as programmatic decisions are made to resolve the outstanding issues. This report (Phase II) is the first update of the Phase I Plan of Action issued in February 1994. The "phased approach" is more fully explained in Section F of the Introduction.

Individual corrective actions to resolve vulnerabilities are discussed in Section IV for those activities in which funding currently exists and pertinent policy issues have been resolved. For consistency, the detailed corrective actions presented in the corresponding appendix also list only those activities that are currently funded. Individual action plans for given vulnerabilities in the appendices are "complete" or "partial" depending on whether all necessary activities are listed. If all component activities for a given vulnerability are funded, then they are all listed, and the action plan is considered "complete." If some activities for a given vulnerability are considered necessary but are not funded, then only the funded activities are listed and the individual plan in the appendix is identified as "partial."

As discussed, some individual action plans provided in the appendices are incomplete because of unresolved issues. In this, the Phase II Report, finalized individual actions for the 106 vulnerabilities have increased from 44 (Phase I) to 81; the number of partial actions now stands at 25. This means that all vulnerabilities are now addressed by either a complete or partial individual plan. The completion of the partial action plans will be addressed in Phase III. Priority continues to be given to those vulnerabilities with the highest potential risk, particularly those associated with concerns related to worker health or safety.

Below is a table that summarizes, by category, the current status of efforts to address the 106 vulnerabilities.

Classification of Vulnerability	Action Plans Developed (Phase I & II)	Action Plans Partially Developed (Phase I & II)	Totals
Eight Priority Facilities	30	3	33
To Be Addressed in less than 1 Year	10*	1*	11*
	27	8	35
To Be Addressed in greater than 1 Year	14	13	27
Totals	81	25	106

* These are associated with the eight priority facilities.

Appendix C contains all the new action plans; i.e., action plans for those facilities that were not addressed in Phase I and for vulnerabilities not addressed in Phase I (even though their associated facilities were discussed with respect to other vulnerabilities).

Appendix D contains a listing of the entire 106 vulnerabilities and identifies both the priority (eight priority facilities, action less than one year, action greater than one year) and the current status of the individual action plan (complete or partial).

C. Eight Facilities With Major Vulnerabilities

The eight facilities identified by the Working Group as having major vulnerabilities are listed below by site. A summary of the vulnerabilities and the action plans for these eight facilities is provided in Section IV.A. The complete action plans are provided in Appendix A.

Hanford Site

- K-East Basin
- PUREX Canyon
- 200 West Burial Grounds

Savannah River Site

- L-Reactor Disassembly Basin
- K-Reactor Disassembly Basin

Oak Ridge Site

- Classified Burial Ground (Subsequently, this material was found to be located in Solid Waste Storage Areas 5 and 6)
- Homogeneous Reactor Experiment Disposal Wells

Idaho National Engineering Laboratory

- CPP-603 Fuel Storage Facility

D. Five Common Fundamental or Generic Issues Identified

In addition to the specific site vulnerabilities, the Working Group identified five fundamental (generic) issues that are common to many DOE spent fuel storage facilities. These generic issues will require careful consideration by all facilities during future planning and decision making activities and will be taken into consideration when developing individual action plans.

The generic issues identified by the Working Group are:

- Lack of Approved and Current Authorization Bases
- Seismic Design Inadequacies
- Lack of Programmatic Ownership
- Lack of Complete Material Characterization
- Lack of Specified Path Forward

The Department has established an integrated spent fuel program under the Assistant Secretary for Environmental Management (EM) that will address these and other issues related to spent fuel management throughout DOE. The need for approved and current authorization bases for facilities throughout the DOE complex is being addressed by a DOE-wide program under EM's Office of Safety and Health Oversight. Concerns relative to the authorization bases for spent fuel facilities will be addressed in the larger context of this existing DOE program. Material characterization and identification of a path forward are virtual cornerstones for this Plan of Action; individual corrective actions are strongly dependent on material characterization, and the overall Plan of Action (Phases I, II, and III) is the defined "path forward." To address the need for long-range planning, the Spent Nuclear Fuel Strategic Plan is in the early stages of

development. Seismic design inadequacies must be addressed on a case-by-case basis. Upgrading to current standards may not be either technically or fiscally prudent; in these cases, retirement of particularly vulnerable facilities in the near term may be the action of preference. Issues regarding programmatic ownership of SNF facilities have been resolved by the Department.

E. Purpose and Scope of the Plan of Action

In conjunction with the preparation of the final report to the Secretary of Energy by the Spent Fuel Working Group, the Office of Waste Management (EM-30) brought together representatives from those sites identified as having the eight facilities with major vulnerabilities in order to determine what actions should be taken to address the vulnerabilities and the prioritization of these actions.

Many of the vulnerabilities were previously known, and action plans are in place to resolve them. However, some vulnerabilities had not been previously identified, or the severity of conditions had not been fully understood and acted upon accordingly. Therefore, on December 1-2, 1993, representatives from each affected site, along with DOE Headquarters personnel and representatives of the Spent Fuel Working Group, evaluated the major vulnerabilities. The plans that the sites had previously developed for the known vulnerabilities were reevaluated in light of the urgency to correct the situation, with specific emphasis on minimizing impact on worker health and safety. The need to mitigate potential environmental impacts and public safety and health was also considered where appropriate.

Based on the evaluation of current plans, additional actions were determined to be appropriate in some instances. The schedule of implementation, funding requirements, and budgetary allocations for the current and newly identified actions were also established. The summary details of the action plans (both partial and complete) for all of the 44 identified vulnerabilities at the eight facilities are contained in Section IV.A; the detailed corrective action plans are contained in Appendix A.

The vulnerabilities not associated with the eight priority facilities have been categorized into two basic areas based on when action should be taken (less than 1 year or greater than 1 year). Based on this categorization process, approximately 35 additional identified vulnerabilities not associated with the eight priority facilities were determined to warrant that action be taken within one year. These have been evaluated, and corrective action plans have been developed accordingly. Phase II includes summary details of the action plans for these 35 vulnerabilities in Section IV.B; the detailed corrective action plans are contained in Appendix B. The remaining 27 vulnerabilities were determined to be less urgent; however, 14 are now fully addressed, and 13 are partially addressed. These are so designated in the listing in Appendix D. For ease of review, all new action plans are provided in Appendix C and will be incorporated into Appendix A or B in Phase III.

Some vulnerabilities are site-specific in nature and can be resolved through actions taken by the affected site and facility. However, vulnerabilities that impact multiple sites require integration at the national level for resolution. The Office of Waste Management (EM-30), with assistance

from the Idaho National Engineering Laboratory (INEL), has coordinated the overall plan of action to address the vulnerabilities identified in the assessment report. All corrective action plans have been integrated with overall program direction to ensure consistent and cost effective solutions. Knowledgeable operations office personnel, management, and contractor personnel have brought the individual action plans together and integrated the responses on a national basis as outlined in Section III.

F. The Phased Approach

The relative magnitude of the problem presented by specific vulnerabilities is a major factor when identifying the urgency in implementing corrective actions. Those problems having implications related to worker protection, or potential for adverse impact on the environment or the public, were assigned appropriate urgency based on: 1) RINM inventory, 2) failure potential of barriers designed to prevent release of radionuclides, 3) uncertainty of RINM storage conditions, and 4) adequacy of facility design conditions including whether the facility is being utilized in a manner for which it was not originally designed.

Every attempt was made to address the vulnerabilities associated with the eight priority facilities and those additional vulnerabilities requiring prompt management attention (less than 1 year) in as short a time frame as possible. However, as discussed previously there are unresolved funding, policy, and technical issues that prevent final development of all action plans at this time. Therefore, the Plan of Action will be issued in three phases. This document constitutes Phase II; Phase I was previously issued in February 1994; and it is anticipated that Phase III will be issued in September 1994. Phases II and III will provide action plans that reflect funding, policy and technical decisions made subsequent to the issuance of Phase I. A brief discussion of each phase follows.

Phase I, the initial Plan of Action, included those facility action plans for which no major outstanding policy or funding issues existed at the time of issue in February 1994. For those action plans, general agreement already existed on the necessary actions and the availability of funding. "Partial" corrective action plans were included in the Phase I Plan of Action in cases where some outstanding funding or policy issues existed. Issues associated with these "partial" plans are to be resolved in the Phase II or III effort.

Phase II, the first update, consists of this updated Plan of Action. Since issuance of the initial Plan of Action, a majority of the funding issues have been resolved. This update includes those individual action plans that have been developed based on resolution of the funding issues.

Phase III, the second update, will be issued in September, 1994, and will include the development of an approach to fully address the remaining vulnerabilities; i.e., those vulnerabilities not addressed in Phases I or II and will focus on the resolution of critical policy issues. Additionally, the update will include stakeholder feedback received on the original Plan of Action and the first update.

G. Activities Already in Progress That Address Identified Vulnerabilities

This updated Plan of Action (Phase II) is comprised of a combination of previously reported activities and newly created individual action plans which address the identified vulnerabilities. In many instances, activities were already in progress that address, at least in part, vulnerabilities identified by the Working Group.

In some cases, the current spent nuclear fuel program is being expanded or modified in order to address identified vulnerabilities. If the strategy put forth in the individual action plan is new, the approach will be implemented as the funds to support the activities become available. The priority of the new individual action plans will dictate how funding is allocated. However, this plan does not directly identify those facility and site costs associated with infrastructure operation, maintenance and/or upgrades necessary for plan implementation. The infrastructure support will be identified through the integration of this plan with site and facility management planning. Note that funding for FY-95 and later years, although expected to be available, is subject to the Federal budget approval process.

From an overall programmatic standpoint, Section III outlines the Department's Spent Nuclear Fuel Program as it is currently being developed. Specific areas are highlighted where programmatic additions or modifications are anticipated. Broad-scope spent fuel program activities already planned or in progress will be integrated into this overall Plan of Action and individual action plans, where appropriate, to assist in addressing specific vulnerabilities.

III. DOE-Owned Spent Nuclear Fuel Program Approach

A. Spent Nuclear Fuel Program Overview

In 1992, the Secretary of Energy directed the Assistant Secretary for Environmental Restoration and Waste Management (EM) to develop an integrated, long-term SNF management program. In response, EM initiated the development of a DOE-owned SNF program to define and ensure resolution of all associated issues for the quantification of DOE spent fuels and fuel storage facilities, fuel characterization, conditioning, interim storage, and preparation for ultimate disposal in a geologic repository.

The purpose of the DOE-owned SNF program is to integrate DOE's existing SNF activities into one program to better control and manage this material, and to ensure that all issues associated with SNF are resolved in a safe and cost-effective manner. The program will ensure full compliance with applicable executive orders, federal, state, and local environmental laws and regulations, national consensus standards, and DOE orders, regulations and policies. The resolution of the identified vulnerabilities is an example of the ongoing complex-wide coordination prescribed by such an integrated programmatic approach. The corrective action plans contained in this report are the result of a complex-wide coordinated effort.

Four outstanding policy issues that greatly affect the future direction of DOE's spent nuclear fuel program have been identified. Resolution of these issues in the near term will permit significant programmatic decisions to be made and thereby establish a clear path forward to address identified vulnerabilities and related problems. These issues are: 1) definition of the path forward for the geologic disposal of spent fuel; 2) the adoption of Nuclear Regulatory Commission licensing and commercial industry standards for new interim storage and conditioning facilities; 3) options for dry storage of N-reactor fuel at Hanford; and 4) the approach to be taken if some DOE-owned SNF is deemed unsuitable for extended interim dry storage or direct geologic disposal and thus requires spent fuel dissolution or processing (e.g., at F & H canyons at Savannah River).

The DOE-owned SNF program encompasses all existing and future DOE-owned SNF (of U.S. origin whether held in international or domestic hands) except for commercial nuclear fuel, which is addressed under the Nuclear Waste Policy Act (NWPA).

The scope of the DOE-owned SNF program consists of a wide variety of activities, two of which are specifically related to the actions described in this Plan of Action:

- Assessment/identification of all existing and potential fuel storage capabilities with associated issues and concerns
- Development of action plans to address near term issues in order to support the budget formulation purposes

In developing this Plan of Action, results of these two activities were fully incorporated into the overall programmatic planning activities aimed at developing responses to the identified vulnerabilities.

B. Organizations, Authorities, and Responsibilities

The Deputy Assistant Secretary for Waste Management (EM-30) within the Office of Environmental Management maintains primary programmatic and budgetary authority and responsibility for the DOE-owned SNF program. However, certain budgetary and program responsibilities for specific facilities covered in the Working Group Report continue to reside in other EM offices, as well as in DOE's Offices of Defense Programs, Nuclear Energy, and Energy Research. Program management integration has been assigned to the Office of Spent Fuel Management and Special Projects (EM-37) with support from the Idaho National Engineering Laboratory (INEL). Technical Working Groups have been established to address the major technical issues.

C. Supporting Documents

The Spent Nuclear Fuel Strategic Plan will articulate the mission, vision, objectives, and strategies for management of DOE-owned spent nuclear fuel. This plan will be developed through a cooperative effort between DOE Headquarters, Operations Office personnel, and stakeholders. It is scheduled for completion by October 31, 1994, but will be updated as appropriate based on the SNF Management/INEL ER&WM Environmental Impact Statement.

The program also involves a broad spectrum of activities requiring specific plans or implementation documentation. The documents listed below which are currently in preparation may require specific modification as a result of the development of this Plan of Action, as well as the Record of Decision resulting from the SNF Management/INEL ER&WM Environmental Impact Statement.

- *Program Management Plan* - This plan outlines the SNF program, including its scope, mission, strategy, approach, organizations involved, stakeholder participation, and schedule.
- *Technology Integration Plan* - The technologies required for safe interim storage and final SNF disposition are being coordinated among DOE sites.
- *Interim Storage Plan* - An interim storage plan is being developed for all DOE SNF that considers retirement of obsolete storage facilities, new construction, existing fuel and fuel condition, and planned new facilities.
- *Characterization Plan* - A characterization plan is being developed to identify all fuel data needed to safely store the material for an interim period and to begin preparations for final repository disposition.
- *DOE Site-Specific Program Documents* - Site-specific SNF documents have been or will be developed at the principal DOE sites involved with the management and disposition of DOE-owned SNF. These documents will be comparable in nature to the national program documents with greater implementation detail consistent with site-specific requirements. Included with these site-specific SNF documents will be fuel movement and consolidation plans for each particular DOE site. Examples of these site plans will be the Hanford Fuels Integrated Management Plan and the INEL Integrated Spent Fuel Consolidation Plan that are presently under development.

IV. Facility Corrective Action Plans

This section summarizes those specific actions to be taken at individual facilities to resolve the identified vulnerabilities. The corrective action plans are presented in three broad sections: 1) Section IV.A, those eight facilities identified as having major vulnerabilities; 2) Section IV.B, those facilities having vulnerabilities that should be addressed within one year; and 3) Section IV.C, those facilities with vulnerabilities which were not addressed in Phase I. It should be noted that an action plan step marked as "Reserved" indicates that a specific action has been proposed, but that a funding or technical issue needs to be resolved.

A. Facilities Having Major Vulnerabilities

As previously explained, vulnerabilities at eight facilities were identified as being of much higher priority than those at the remaining facilities. The current plans that parent sites had previously developed for the known vulnerabilities have been reevaluated in the light of the urgency to correct the problems identified at these eight facilities, with specific emphasis on minimizing impact on worker health and safety.

The need to mitigate potential environmental impacts and to protect public safety and health was also considered. Based on the evaluation of current plans, additional actions were determined to be appropriate in some instances because of newly identified vulnerabilities or severity of conditions that were not fully understood previously. The schedule of implementation and corresponding funding requirements for the current and newly identified actions were established.

Summaries of the corrective action plans for each of the facilities with major vulnerabilities are presented in this section of the report. Information concerning specific actions, the schedule for such actions, or the funding requirements and status of funding can be found in Appendix A.

Site: Hanford**Facility: K-East and K-West Storage Basins**

The K-East Storage Basin was constructed in 1951 to provide interim storage of Single Pass Reactor fuel discharged from the K-East Reactor until its shutdown in 1970. It was reactivated in 1976 to serve as interim storage for spent N-Reactor fuel awaiting reprocessing. The basin is an unlined, concrete, 1.3 million-gallon water pool with an asphaltic membrane beneath it, and it presently stores approximately 1150 metric tons of heavy metal (MTHM), which equates to about 40% of the total DOE spent nuclear fuel inventory. The K-East Storage Basin inventory -- which is comprised of 50,683 assemblies of N-Reactor production fuel, with a heavy metal weight of 1,152 metric tons, and 138 assemblies of Single Pass Reactor production fuel, with a heavy metal weight of 400 kg -- has been stored under water in open-top canisters for periods ranging from 6 to 23 years.

The K-West Storage Basin was constructed at the same basic time as the K-East Storage Basin to provide interim storage of Single Pass Reactor fuel discharged from the K-West Reactor until its shutdown in 1971. It was reactivated in 1981 to serve as interim storage for spent N-Reactor fuel awaiting reprocessing. The basin is an unlined, concrete, 1.3 million-gallon water pool with an asphaltic membrane beneath it, and it presently stores approximately 961 metric tons of heavy metal. The inventory is comprised of 52,959 assemblies of N-Reactor production fuel, with a heavy metal weight of 961 metric tons, and 47 assemblies of Single Pass Reactor production fuel, with a heavy metal weight of 100 kg. The inventory equates to about 38% of the total DOE spent nuclear fuel inventory. The spent fuel was placed in closed canisters before shipment to and storage at the K-West Basin.

As both facilities are very similar, vulnerabilities were identified as being either applicable to both facilities or unique to a specific facility. Only those aspects of vulnerabilities that are applicable to the K-East Basin were considered major vulnerabilities warranting priority management attention.

The vulnerabilities identified for the K-East / K-West Basins are as follows:

- Sludge accumulation containing fissile and fission product material from damaged / degraded fuel is estimated to be several inches deep in most locations. Up to 50% of the fuel may have experienced cladding failure, and approximately 90% of the canisters that contain the fuel have at least one fuel assembly with breached clad, resulting in the release of significant amounts of fission products to the pool. (HAN-1-1 / K-East)
- An efficient method for encapsulation may be needed to avoid additional releases to the environment and attendant high worker exposures. (HAN-1-2 / K-East)
- K-East Basin has leaked twice, releasing fission products and tritium to the environment. The source is believed to be the basin discharge chute construction joint, which is also a potential seismic vulnerability due to lack of adequate reinforcement. (HAN-1-3 / K-East & K-West)
- Institutional control failures; lack of clear planning priorities for final disposition of material. (HAN-1-4 / K-East & K-West)

- An unreviewed safety question (USQ) exists concerning excessive plutonium accumulation in the filter backwash pit. (HAN-1-5 / K-East)
- Creation of TRU waste associated with basin operations. There is presently no disposal path for the mixed bed ion exchange resin waste. (HAN-1-6 / K-East)
- Monitoring wells in proximity of basin indicate increasing levels of tritium approaching -- and in one case, exceeding -- the safe drinking water limit of 20,000 picocuries/liter and also indicate possible migration to the Columbia River. (HAN-1-7 / K-East)
- Uncharacterized fuel is stored in unsealed canisters at K-East Basin; there is a lack of precise detail as to the material condition of some of the RINM in storage. (HAN-1-8 / K-East and K-West)

In addition to the specific vulnerabilities that were identified, one generic issue was found to be applicable:

- Lack of adequate authorization bases, including updated and approved Safety Analysis Report (SAR), that address long-term storage of RINM. (K-East and K-West)

Information will be provided for the K-East Basin first, and any supplementary information will be provided for the K-West Basin as appropriate. Cost and schedule information does not include normal operations/maintenance activities at the 105-K Basins.

K-East Storage Basin

Up to 50% of the fuel may have experienced cladding failure, and approximately 90% of the canisters containing the fuel may have at least one fuel assembly with breached clad. This has resulted in the release of significant amounts of fission products to the pool. The cladding failure is due to corrosion and/or damage from handling. Accumulation of sludge, containing radionuclides, corrosion products, and miscellaneous material, has occurred at the bottom of the basin at an estimated total volume of 500 to 1000 cubic feet. The depth of the sludge is uniformly several inches deep and is over a foot deep in the back wash sand filter pit. Due to the deteriorated state of this fuel and the significant accumulation of sludge, concerns have been raised that plans for encapsulation of the fuel and sludge may need further evaluation to ensure that additional releases to the environment and attendant high worker exposures are avoided. At present, precise details are not known regarding the quantity of corroded fuel, the rate at which corrosion occurs, the potential effects of encapsulation on the corrosion rate, and the effects that corroded material may have on a vented sealed container.

Water has leaked from the basin on at least two occasions, releasing fission products and tritium to the environment. The source of these leaks is believed to be the basin discharge chute construction joint, which is also a potential seismic-related vulnerability due to the lack of adequate reinforcement. The basin is suspected as being the source of tritium currently detected by monitoring wells in proximity to the facility. Although the number of existing monitoring wells near the facility is not sufficient to conclusively determine the state of groundwater contamination which may exist in the proximity of the basin, these monitoring wells are detecting increasing levels of tritium that are approaching -- in one case, exceeding -- the safe drinking water limit of 20,000 picocuries per liter. The readings of the

monitoring wells indicate that a migration toward the Columbia River may be occurring.

An unreviewed safety question (USQ) was recently determined to exist due to the plutonium concentration technical safety requirement (TSR) limit being exceeded in the sand filter backwash pit. It has subsequently been determined that the amount of plutonium was within authorized limits. The high concentration of plutonium in the basin has also resulted in the considerable accumulation of transuranic (TRU) waste as ion exchange resin columns become depleted and require replacement. Presently there is no specified disposal path for the mixed waste ion exchange resin. Additional problems exist, such as the potential for combustible conditions due to hydrogen generated in the spent resins media and the high radiation dose rates associated with spent resin handling.

It was determined that a significant vulnerability exists due to the lack of clear planning and priorities for final disposition of material in the K-East Basin, due to frequent organizational and personnel changes, and due to the lack of assigned accountability for resolution of environmental safety & health (ES&H) concerns.

In addition, although not identified as a specific vulnerability, one of the generic issues (i.e., an issue applicable to all facilities determined to require priority management attention) is applicable to the K-East and K-West Basins. It involves the lack of an adequate authorization basis, including an updated and approved Safety Analysis Report (SAR) that addresses long-term storage of SNF.

The Defense Nuclear Facilities Safety Board (DNFSB) report of January 27, 1994, describes observations and conclusions regarding activities to be undertaken to stabilize the degraded spent fuel at K-East Basin. The Board has requested that DOE prepare a response to this report within sixty days addressing four specific issues, as follows. This response is presently in the stages of final approval.

- (1) A description of the engineering alternatives that were considered in arriving at the presently planned fuel/sludge encapsulation approach.
- (2) A list of the criteria used in making the selection for the planned fuel/sludge encapsulation approach.
- (3) A description of any additional systems engineering studies planned to ensure that personnel radiation exposure and radionuclide releases to the environment are maintained at levels as low as are reasonably achievable.
- (4) The anticipated radiation doses and dose commitment from the proposed fuel/sludge encapsulation.

The activities that are underway or have been completed related to the DNFSB's concerns are: the engineering review of the encapsulation process and the establishment of an independent As Low As Reasonably Achievable (ALARA) assessment team. These are described under Objective 2.

An action plan has been developed to resolve these vulnerabilities while proceeding to achieve the goals of meeting those milestones and target dates established in the Tri-Party Agreement (TPA) between the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology, and DOE, and ensuring a minimum impact on the worker, the public, and the environment. The Agreement

identifies that removal of SNF, sludge, and tritium from the basin water should be completed by December 2002. It should be noted that many of these actions had been planned prior to the performance of the assessment. Seven main objectives have been identified in order to achieve this goal.

- 1) Reduce the potential environmental and health consequences of the current mode of fuel storage in open canisters by encapsulating the fuel material, thereby reducing environmental risks and the rate of radionuclide release into the basin pool.

Hanford initially developed an aggressive program to begin encapsulating fuel in the K-East Basin (in stainless steel canisters similar to the latest Mark II canister used to encapsulate spent fuel in the K-West Basin) by June 1994. The initial encapsulation activity will be comprised of a pilot run to identify the performance of the currently planned encapsulation process. A revised pilot run fuel encapsulation schedule will be issued by Westinghouse Hanford Company to DOE-RL by May 2, 1994 and may result in a delay. Primary reasons for this potential delay are due to technical uncertainties of fuel condition and integrity and effectiveness of encapsulation procedures and equipment. Additional reasons for the potential delay are conduct of operations issues resulting from the facility plant readiness process and revisions to the readiness review process in conducting a WHC and DOE Operational Readiness Review. The pilot run, in conjunction with other ongoing/planned technical evaluations and limited fuel characterization, will provide information necessary to determine whether the currently planned encapsulation process should be performed as planned, modified, or replaced by an alternative process for reducing the environmental risks. (The currently planned encapsulation process is used as the basis for corrective action schedules and costs.)

Beginning in or before June 1996, encapsulation of sludge in the basin will be initiated. The technical solution for sludge encapsulation needs to be identified and selected. Engineering assessments will be performed in 1994 with the purpose of selecting an approach for sludge containment by September 1994. The encapsulated spent fuel and sludge will be moved from K-East basin to a new facility for long-term interim storage. Design and construction activities for a Hanford Site SNF interim storage/stabilization facility are currently being evaluated. This evaluation includes possible procurement alternatives in order to provide the most cost-effective storage facility.

Since approximately 78% of DOE's spent nuclear fuel is stored in the Hanford K-East and K-West Basins, and the condition of the fuel is relatively poor, the prudent course of action is to put the fuel in a safe, secure interim storage configuration, and to do so at minimum risk to the public and workers, at minimum cost to the government, and in a manner that is environmentally acceptable. Existing plans are in place to encapsulate the fuel and sludge in the K-East Basin, as well as to clean up the water in the basin. Once the fuel and sludge are encapsulated and the water cleaned up, the potential environmental impact from basin leakage will be mitigated. Encapsulation provides a barrier to the release of fission products to the basin water. However, it does not lessen fuel degradation, nor does it prepare the fuel for long-term storage. An integrated plan to deal with the fuel from the present encapsulated state until it is taken for ultimate disposal in a repository is needed.

- 2) Minimize worker exposures by evaluating the potential radiological impact of planned encapsulation activities.

The K-East Basin operating staff has established an independent formal ALARA (As Low As Reasonably Achievable) assessment team to ensure that potential personnel radiation exposures resulting from planned encapsulation activities will be minimized. The ALARA assessment team, which includes encapsulation workers, will evaluate planned activities. The assessment team will also evaluate issues such as potential work improvements and design considerations for the encapsulation, overpacking of existing canisters, and the potential application of a basin coating near the water line to reduce radiation levels. To reduce staffing needs during encapsulation, requirements such as those for special nuclear material accountability will be evaluated to determine if waivers or changes are warranted, because in some cases the fuel is not, or may not be when moved, in an accountable form. In addition, it is expected that a detailed rehearsal of each step of the encapsulation process will provide many process enhancements to minimize worker exposure. An initial ALARA assessment has been completed, and further assessments will be performed throughout the encapsulation activities.

In November 1993, an engineering review of encapsulation methods, which evaluated some "overpack" designs, was completed. The review contains the recommendation to use the intended canisters and the basic encapsulation process with minor enhancements to capture as much sludge as possible during the canister "dumping" and movement of open-bottom canisters. The review identified several potential enhancements to the process, and these will be evaluated by a K-Basin team concurrently with encapsulation preparations.

- 3) Establish a plan to mitigate environmental insult from basin leakage -- while not impacting TPA goals of providing a barrier for the fuel -- by removing fuel and sludge from the basins by 2002. In addition, minimize the consequences of leakage which may be caused by a seismic event or construction joint degradation.

Efforts are being made to define and characterize the potential leakage of the K-East Basin. Information to date shows that the leak rate from the basin may be as little as 5 to 10 gallons per hour. Since the groundwater samples to date have not contained radionuclides, aside from tritium, found in the basin water -- e.g., cesium and strontium -- but the samples have contained carbon-14, which is not found in the basin water, some doubt exists as to the source of the radioactivity in the well samples. An evaluation of the hydrology surrounding the K-Area will be performed, and an analysis to define the source of tritium and C-14 in the groundwater will be conducted. To reduce the tritium concentration in the basin water, which may be leaking into the environment, an evaluation will be performed to determine the optimum means of lowering the tritium concentration in the basin.

Past leakage from the basin was determined to be associated with a construction joint for the basin discharge chute (between the foundations for the K-Reactor and the basin), and the joint had previously been patched. However, the groundwater samples taken from monitoring wells surrounding the basin contain tritium contamination, which may be the result of basin water leakage into the soil. A leak mitigation plan has been developed for use in the event of a

renewed basin leak. The plan calls for protection of the construction joint during encapsulation activities and for the use of cofferdams (fabrication is complete) which would be temporarily installed, if necessary, to mitigate significant leakage until the appropriate repairs can be made. A cofferdam will be installed in the discharge chute area of the K-West Basin in order to finalize the installation procedure and to verify the suitability of the installation in the event that cofferdam use is needed in K-East Basin. Installation of the cofferdams precludes encapsulation of the SNF and sludge, because it prevents movement of fuel from the basin to the discharge chute area where encapsulation activities are performed.

- 4) Resolve the USQ involving the high concentration of plutonium in the filter backwash pit in a timely manner which does not impact fuel encapsulation and ensures worker safety.

Resolution of the Sand Filter Backwash Pit USQ is in progress. The issue concerns a lack of adequate characterization of sand filter backwash pit contents. A rigorous Sampling Analysis Plan was developed (and it was determined that the pit contained 97 grams Pu, which puts it within the limit of 225 grams), and the analytical results verified that a USQ does not exist. Operational controls are being implemented to prevent exceeding the present 225 gram limit. New OSR limits will be implemented as part of the Interim Safety Basis effort if deemed necessary.

- 5) Provide effective basin water cleanup systems that do not create waste forms not readily acceptable by current practices.

A waste plan is in development. K-Basin has identified a container to store the cartridge filters as TRU waste at the Hanford Central Waste Complex. The used ion exchange columns stored at K-Basin are vented and have minimal heat generation from internal radiation sources. An analysis has been performed, and it has determined that the levels of hydrogen in the ion exchange columns were below flammable limits. The existing ion exchange columns have been classified as low-level waste. A waste plan is being developed, and it includes the following:

- Begin utilization of container identified to store the cartridge filters as TRU waste at the Hanford Central Waste Complex.
- Determine whether the ion exchange columns are either TRU waste or low-level waste (LLW).
- Dispose of the LLW ion exchange columns at the Burial Ground.
- Develop a waste form and containers for the TRU waste from the ion exchange columns.
- Store the TRU waste at the Hanford Central Waste Complex.
- Identify alternative clean-up systems to minimize the generation of TRU waste.
- Reevaluate canister disposal and implement recommendations, as appropriate.

6) Characterize fuel in the K-East Basin.

Perform the technical evaluations and fuel characterization tests necessary to assist in development of the path forward for removal of fuel from the facility. Work activities will include development of a fuel characterization test plan, completion of test implementation activities, performance of test, and analysis and documentation of test results. The tests will provide analytical information sufficient to evaluate the acceptability of wet encapsulation and will identify minimum conditions necessary for dry storage, for preparation for dry storage, and for transport of the fuel. Information will support establishment of safety envelopes, process selection and development, and regulatory compliance. The test results will also be used to establish direction for follow-on waste form performance tests and other steps necessary to develop a path forward for fuel disposition.

7) Define planning and priorities for interim disposition of material in K-East, and assign accountability for resolution of ES&H concerns. Also, update the authorization basis for the facility.

The effect of establishing the Tri-Party Agreement milestone to complete the removal of fuel and sludge from the K-Basins by the year 2002 has served to draw the proper organizations together and to identify the program ownership.

It will be necessary to have a properly developed and integrated management plan in order to successfully implement programs which: (1) generate the information necessary in order to make the needed aforementioned decisions; (2) address the vulnerabilities related to encapsulation, leakage, and basin water treatment; and (3) plan and implement program activities that coordinate near term actions with longer range safe storage options for the spent fuel. The Hanford Fuels Integrated Management Plan is being developed to address the scope and schedule for tasks and sub-tasks which will contribute to the future decision-making process. Any proposed future locations for the storage of all the spent fuel at Hanford, NEPA documentation, and descriptions of K-East Basin activities (fuel/sludge encapsulation and characterization, ALARA planning, and new facility acquisition) will be incorporated into the Hanford Fuels Integrated Management Plan.

To support near term DOE decisions on dry storage as an alternative or as the next step in the currently planned encapsulation process, DOE-Richland is commissioning an independent technical assessment to evaluate requirements needed for safe, long-term interim storage of the SNF presently contained in K-East Basin in a dry storage medium. (This assessment is also adaptable to other fuel stored at Hanford such as K-West Basin, PUREX). The feasibility report will identify the conditioning steps necessary to stabilize the SNF from the open-top canisters in K-East, the packaging and transportation requirements, and a preliminary scope of new facility requirements. A preliminary feasibility report will be prepared by the end of May 1994. As a follow-on activity, should dry storage appear feasible and desirable -- and dependent on results of the encapsulation pilot run and associated technical evaluation -- the assessment team will further define facility requirements to allow an estimate of costs and to support an appropriate NEPA review for the concept.

A Basin Consolidation Study will be performed to determine whether single-basin occupancy (K-West Basin only) or dual-basin occupancy (K-East and K-West) will be used for temporary storage of the fuel presently at K-East and K-West Basins and of the encapsulated sludge at the K-East Basin for the period through 2002. Based on the results of the Basin Consolidation study, a schedule will be developed for the K-East Basin Water Tritium Reduction Program.

A Hanford Site-wide Environmental Impact Statement for the long-term management of spent fuel at Hanford will be developed, and a Record of Decision will be issued by June 1996. This will support the work already in progress for the DOE Programmatic Spent Nuclear Fuel Management and INEL Environmental Restoration and Waste Management Programs Environmental Impact Statement, which is scheduled for the issuance of a Record of Decision by June 1995.

Reorganization for more effective management of the K-Basin program was requested of the contractor by the Operations Office during the last fiscal year, and the contractor responded by establishing the SNF Project Organization to manage more effectively disposition of SNF for the Hanford Site. Increased staffing levels are being provided to accommodate efforts such as fuel characterization, engineering studies, and NEPA documentation preparation.

Since reducing the risk of spent fuel storage is a very high priority, the strategy for accomplishing these actions will include: (1) a review of the above to ensure efficient plans are in place to accomplish the most critical actions, and (2) a re-prioritization at Hanford and other sites, if required, to accomplish necessary activities.

An Interim Safety Basis will be developed in order to establish the current authorization basis for the K-East Basin.

K-West Storage Basin

The condition of the spent fuel in the K-West Basin is unknown, since the fuel was placed in closed canisters before shipment to and storage at the K-West Basin. There is essentially no sludge in the K-West Basin because all of the fuel is in closed containers. The K-West Basin is not known to have leaked, but it is similar in design to the K-East Basin in that there is a discharge chute construction joint, which is believed to be the source of previous leakage at the K-East Basin. This joint also poses a potential seismic-related vulnerability due to the lack of adequate reinforcement. A cofferdam will be installed in the discharge chute area of the K-West Basin in order to finalize the installation procedure and to verify the suitability of the installation in the event that cofferdam use is needed in K-East Basin. This will reduce the possibility of a seismically induced leak at the K-West Basin. In order to detect potential future basin leakage more effectively, three groundwater monitoring wells in the vicinity of the K-West Basin have begun to be installed as of January 1994.

The Basin Consolidation Study will determine whether single basin occupancy (K-West Basin only) or dual basin (K-East and K-West) will be used for temporary storage of the fuel presently at K-East and K-West Basins and the encapsulated sludge at the K-East Basin for the period through 2002. The fuel characterization activities being performed for the K-East Basin fuel will also be performed for the K-West Basin fuel.

The independent technical assessment to evaluate requirements needed for safe, long-term interim storage of the SNF presently contained in K-East Basin in a dry storage medium will also be utilized to address the fuel stored at the K-West Basin.

An Interim Safety Basis will be developed in order to establish the current authorization basis for the K-West Basin.

Additional actions will be included in Phase III of this report.

APPENDIX A
Action Plans for Major Vulnerabilities

Identified Vulnerabilities	Corrective Action Plans	Schedule
<p>IIAN I-2 (Continued)</p>	<p>IIAN I-2 (Continued)</p> <p>c Establish an independent ALARA assessment team which includes encapsulation workers to perform a review to reduce personnel exposure caused by the planned encapsulation work. The assessment will evaluate planned activities, potential work improvements / design enhancements for encapsulation, overpacking existing canisters and consideration of basin coating to reduce radiation levels. Detailed walk-throughs of each step of the encapsulation process will identify process enhancements to minimize worker exposure.</p> <p>- ALARA assessment team complete development of encapsulation ALARA plan.</p> <p>d Initiate implementation of recommendations from various assessments (see items I-2a, b & c) for fuel and sludge encapsulation to support the respective encapsulation-related activity start dates (see items I-1b and c).</p> <p>e Evaluate basic requirements such as SNM accountability requirements for waivers or changes to minimize personnel exposure during encapsulation. Implement recommendations.</p> <p>f Raise basin water level to provide additional shielding.</p>	<p>Initial review and changes completed 12/93.</p> <p>4/94</p> <p>Ongoing</p> <p>4/94</p> <p>6/94</p>
<p>I-3 105 KE Basin leaked twice releasing fission products and tritium to the environment. Source believed to be the basin discharge chute construction joint, which is also a potential seismic vulnerability due to lack of adequate reinforcement. (Generic Issue, 105-KE and 105-KW)</p>	<p>I-3 Install K-East Basin construction joint protection in the basin during the encapsulation activities. Fabricate cofferdams to be installed if necessary for mitigation should significant leakage occur, until the appropriate repairs can be performed. (Cofferdam installation precludes encapsulation of the SNF and sludge.)</p> <p>- Installation of construction joint protection in K-East Basin.</p> <p>- Cofferdam prepared for installation in K-East Basin if needed.</p> <p>- Fabricate an additional cofferdam and install in K-West Basin. This will demonstrate installation feasibility and will reduce the possibility of a seismically induced leak at the K-West Basin.</p>	<p>Complete</p> <p>Completed 12/93</p> <p>6/94</p>

Identified Vulnerabilities	Corrective Action Plans	Schedule
<p>IIAN</p> <p>1-1 Sludge accumulation containing fissile and fission product material from damaged / degraded fuel is estimated to be greater than 14 inches deep in some locations. Greater than 50% of the fuel may have experienced cladding failure, releasing significant amounts of fission products to the pool. (105-KE)</p>	<p>IIAN</p> <p>1-1a Evaluate / develop encapsulation methodology (see items 1-2a, b and c).</p> <p>b Begin pilot encapsulation of K-East Basin fuel in MK II canisters to provide near term isolation of fuel from basin water.</p> <p>c Perform Basin Consolidation Study (see item 1-4b) to provide basis for decision on relocation of all fuel from 105-KE to 105-KW and for schedule to reduce tritium concentration in 105-KE Basin water.</p> <p>d Initiate fuel and sludge characterization to develop options for fuel and sludge management at basins and to develop path forward for removal of both from 105-KE Basin.</p> <p>e Develop sludge encapsulation system.</p> <p>f Initiate sludge packaging / encapsulation.</p> <p>g Implement actions necessary to identify and develop a path forward for removal of all fuel and sludge from 105-KE Basin by 12/02.</p> <p>h Complete encapsulation of fuel.</p> <p>i Complete encapsulation of sludge.</p> <p>j Initiate removal of all fuel and sludge from 105-KE and 105-KW Basins (including stabilization and placement in interim storage).</p> <p>k Remove all fuel and sludge from K-Basins.</p>	<p>See item 1-2</p> <p>6/94</p> <p>See item 1-4b</p> <p>10/94</p> <p>6/96</p> <p>6/96</p> <p>See item 1-4h</p> <p>6/96</p> <p>12/98</p> <p>12/00</p> <p>12/02</p>
<p>1-2 An efficient method for encapsulation may be needed to avoid additional releases to the environment and attendant high worker exposures. (105-KE)</p>	<p>1-2a Provide evaluation of encapsulation approach, through an independent group, to identify whether encapsulation should proceed and to recommend improvements to the planned encapsulation approach.</p> <p>b Provide review of plans for encapsulation in EM-37 Comprehensive Technical Assessment and identify findings and recommendations related to encapsulation.</p>	<p>Initial review Completed 12/93</p> <p>Complete</p>

Identified Vulnerabilities	Corrective Action Plans	Schedule
<p>IIAN I-4 Institutional control failures; lack of clear planning priorities for final disposition of material. (Generic Issue, 105-KE and 105-KW).</p>	<p>IIAN 1-4a Develop Hanford Fuels Integrated Management Plan to establish long-term interim storage plans for management of all spent fuel presently stored at Hanford.</p> <ul style="list-style-type: none"> - Preliminary draft available for review and comment. - Issue Hanford Fuels Integrated Project Management Plan. - Implement project control system. - Maintain project control system. <p>b Perform Basin Consolidation Study to decide between utilizing single basin occupancy (105-KW) or dual basin (105-KE and 105-KW) occupancy for temporary storage of fuel and sludge for the period up to 2002.</p> <p>c Perform technical evaluation and fuel characterization tests to develop path forward for removal of fuel; develop fuel characterization test plan, analyze test performance and document results. The tests will provide analytical information in order to identify the minimum conditions necessary for storage (including stabilization) and transport of the fuel. Information will support establishment of safety envelopes, process selection and development, and strategy for regulatory compliance.</p> <ul style="list-style-type: none"> - Initiate sludge / fuel characterization. - Activities to support Title II design - dry storage option. - Activities to support licensing - dry storage option. - Technical evaluation only - wet storage option. <p>d Perform evaluation to determine the appropriate location for acceptable long-term interim storage of fuel removed from K-Basins.</p> <p>e Develop Hanford site wide EIS and issue Record of Decision for long-term management of SNF at the Hanford Site (SNF storage siting and configuration, path forward for ultimate disposition, etc).</p> <p>f DOE-RL commission an independent technical assessment of the feasibility of placing the N-Reactor fuel presently stored in the K-Basins into dry storage in the near term.</p> <ul style="list-style-type: none"> - Provide initial report to EM-37. 	<p>Complete 8/94 10/94 Ongoing</p> <p>9/94</p> <p>10/94 3/96 9/97 9/95</p> <p>3/96</p> <p>6/96</p> <p>5/94</p>

Identified Vulnerabilities		Corrective Action Plans	Schedule
IIAN I-4 (Continued)		IIAN I-4 (Continued) g Design and construct long-term interim storage facility (including stabilization capability): RESERVED ¹ Note: Design and construction activities for a Hanford site SNF interim storage / stabilization facility are currently being evaluated. This evaluation includes possible procurement alternatives in order to provide the most cost effective storage facility.	
		h Remove all fuel and sludge from K-Basins (including stabilization, as necessary, to prepare fuel for storage).	12/02
	I-5 An unreviewed safety question (USQ) exists resulting from excessive plutonium accumulation in filter backwash pit. (105-KE)	I-5a Obtain representative samples of sand filter backwash pit sludge and analyze for plutonium content. b Disposition USQ using plutonium concentration data and Safety and Criticality Analyses information. Note: Results demonstrated that less than 97 grams of plutonium are present compared to a limit of 225 grams. Therefore, this occurrence does not involve an Unreviewed Safety Question.	Complete Complete
	I-6 Creation of TRU waste associated with basin operations. There is presently no disposal path for the mixed bed ion exchange resin waste. (105-KE)	I-6a Perform an analysis to determine whether the degradation of the ion exchange resins results in the generation of explosive or flammable levels of hydrogen. (NOTE: Analysis determined that the levels of hydrogen were below flammable limits.) b Develop a waste plan which includes the following: - Begin utilization of container identified to store the cartridge filters as TRU waste at the Hanford Central Waste Complex. - Determine whether the ion exchange columns are either TRU Waste or Low-Level Waste (LLW). - Transfer the LLW ion exchange columns to the Burial Ground. - Develop a waste form and containers for the TRU Waste from the ion exchange columns. - Transfer the TRU Waste to the appropriate storage facilities. - Identify alternative clean-up systems to minimize the generation of TRU Waste. - Re-evaluate canister disposal and implement disposal process.	Completed 12/93 Complete Complete 10/94 4/95 6/95 6/94 8/96

Note: 1 Activities will be included in Phase III of this report.

Identified Vulnerabilities	Corrective Action Plans	Schedule
<p>I-7 Monitoring wells in proximity of basin indicate increasing levels of tritium approaching (in one case, exceeding) the safe drinking water limit of 20,000 pCi/l and possible migration to the Columbia River. (105-KE)</p> <p>I-8 Uncharacterized fuel is stored in unsealed canisters; lack of precise detail as to the material condition of some of the RINM in storage. (Generic Issue, 105-KE and 105-KW)</p> <p>S-1 Sitewide classification of DOE Spent Nuclear Fuel (SNF) and Special Nuclear Material (SNM) materials as Hazardous Waste.</p> <p>Generic Issue:</p> <p>Lack of adequate authorization bases, including updated and approved SAR that address long-term storage of RINM. (105-KE and 105-KW)</p>	<p>HAN</p> <p>I-7a Analyze the present Ground Water Monitoring Program to determine what enhancements would better define the source of the tritium in the wells.</p> <p>b Implement recommended enhancements which may include installation of new monitoring wells.</p> <p>c Perform Basin Consolidation Study (see item 1-4b).</p> <p>d Based on the results of Basin Consolidation Study, investigate tritium removal options.</p> <p>e Issue a schedule for 105-KE Basin water tritium reduction program.</p> <p>f RESERVED¹</p> <p>I-8 See item 1-4c.</p> <p>S-1a DOE-RL will supply an issue paper to EM-37 describing the institutional and technical impacts which would result if these materials are designated as Hazardous Waste. The paper will include the rationale for maintaining the SNF and SNM classifications for large quantities of SNF and SNM. The paper will also identify a transition point so small quantities of SNF and SNM can be designated as waste. In addition, the issue paper will describe the DOE-RL interpretation of DOE Order 5820.2A documented in correspondence to DOE-HQ in 1991 (see item HAN S-2).</p> <p>b DOE-HQ will then take appropriate steps to resolve this issue.</p> <p>Generic Issue:</p> <ul style="list-style-type: none"> - See item 1-4 - Complete development of Interim Safety Basis. 	<p>Complete</p> <p>5/94</p> <p>Start 10/94 Complete 3/95</p> <p>10/94</p> <p>5/94</p> <p>12/94</p>

Note: 1 Activities will be included in Phase III of this report.

SCHEDULE / FUNDING

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Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30 or as noted)
FY '94	IIAN 1-4c & d	Initiate technical evaluations for wet and dry storage option and siting of a new storage facility.	Ongoing	\$3.0M
	1-2d	Implement recommendations of ALARA assessment for encapsulation.	Ongoing	\$100K
	1-2b	Provide review of plans for encapsulation in EM-37 Comprehensive Technical Assessment and identify findings and recommendations related to encapsulation.	Complete	
	1-4a	Hanford Fuels Integrated Management Plan available for review and comment.	Complete	
	1-6b	Begin utilization of container identified to store the cartridge filters as TRU Waste at the Hanford Central Waste Complex.	Complete	
	1-7a	Analyze the present Ground Water Monitoring Program to determine what enhancements would better define the source of the tritium in the wells.	Complete	
	1-1e	Initiate development of sludge encapsulation system.	Started	
	1-2c	Implement recommendations of ALARA assessment team.	4/94	\$100K
	1-2e	Implement recommendations on SNM waiver.	4/94	\$10K
	1-3	Install construction joint protection in K-East Basin.	Complete	
	1-5a	Obtain representative samples of sand filter backwash pit sludge and analyze for plutonium content.	Complete	
	1-4f	Provide initial report to EM-37 of DOE-RL commissioned independent technical assessment of the feasibility of placing N-Reactor fuel into dry storage in the near term.	5/94	\$500K

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Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30 or as noted)
FY '94 (Continued)	IIAN 1-7b	Implement recommended enhancements which may include installation of new monitoring wells.	5/94	\$300K
	S-1a	Prepare DOE-RL issue paper on SNF.	5/94	\$20K
	1-5b	Disposition USQ using plutonium concentration data and Safety and Criticality Analyses information.	Complete	
	1-1b	Begin pilot encapsulation of K-East Basin fuel in MK II canisters.	6/94	\$4.5M
	1-2f	Raise basin water level.	6/94	\$300K
	1-3	Install cofferdam at K-West Basin.	6/94	\$150K
	1-6b	Identify alternative clean-up systems to minimize the generation of TRU Waste.	6/94	\$250K
	1-4e	Initiate development of Hanford SNF EIS.	6/94	\$800K
	1-4a	Issue Hanford Fuels Integrated Management Plan.	8/94	\$400K
	1-4b	Perform Basin Consolidation Study.	9/94	\$600K
	1-6b	Re-evaluate canister disposal and implement disposal process.	Continue	\$150K

SCHEDULE / FUNDING

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Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30 or as noted)
FY '95	IIAN			
	1-7d	Initiate investigation of options for tritium removal.	10/94	\$50K
	1-1d, 1-4c	Initiate fuel and sludge characterization.	10/94	\$4.4M
	1-6b	Transfer of the LLW ion exchange columns to the Burial Ground.	10/94	\$100K
	1-7e	Issue a schedule for the K-East Basin Water Tritium Reduction Program.	10/94	\$10K
	Generic Issue	Complete development of Interim Safety Basis (Generic Issue).	12/94	\$250K
	1-7d	Complete investigation of options for tritium removal.	3/95	\$50K
	1-6b	Develop a waste form and containers for the TRU Waste from the ion exchange columns.	4/95	\$150K
	1-4g	RESERVED ¹		
	1-6b	Transfer the TRU Waste to the appropriate storage facilities.	16/95	\$25K
	1-4c	Perform technical evaluation for wet storage option.	9/95	Funded
	1-1e	Continue development of sludge encapsulation system.	Continue	Funded
	1-1h	Continue encapsulation of fuel.	Continue	\$7.4M
	1-4a	Implement project control system.	10/94	\$1.8M
	1-4c	Perform technical evaluation, analyses and integration studies for path forward, including wet and dry storage.	Continue	\$3.5M
	1-2d	Implement ALARA assessment recommendations.	Continue	\$700K
	1-4e	Continue development of Hanford SNF EIS.	Continue	\$600K
	1-6b	Continue implementing canister disposal process.	Continue	\$120K

Note: 1 Activities will be included in Phase III of this report.

SCHEDULE / FUNDING

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Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30 or as noted)
FY '96	IIAN 1-4c, 1-4d	Complete technical evaluations for wet and dry storage options and siting.	3/96	\$1M
	1-1h, 1-1f	Complete fuel encapsulation / initiate sludge packaging/encapsulation.	6/96	\$6.7M
	1-4e	Complete Hanford site wide EIS and issue Record of Decision.	6/96	\$600K
	1-1e	Complete sludge encapsulation system development.	6/96	\$500K
	1-6b	Complete canister disposal process.	8/96	\$120K
	1-4c	Continue fuel characterization.	Continue	\$4.9M
	1-4a	Maintain project control system.	Continue	\$1.8M
FY '97	1-4g	RESERVED ¹		
	1-4g	RESERVED ¹		
	1-4c	Perform licensing support activities for the dry storage option.	9/97	Funded
	1-1i	Continue sludge encapsulation.	Continue	\$6.0M
	1-4c	Continue characterization.	Continue	\$3.4M
	1-4a	Maintain project control system.	Continue	\$1.8M
	1-7f	RESERVED ¹		

Note: 1 Activities will be included in Phase III of this report.

SCHEDULE / FUNDING

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Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30 or as noted)
FY '98	IIAN 1-1i	Continue sludge encapsulation.	Continue	\$5M
	1-4a	Maintain project control system.	Continue	\$1.8M
	1-4g	RESERVED ¹		
FY '99	1-1i	Complete sludge encapsulation.	12/98	\$2M
	1-4a	Maintain project control system.	Continue	\$1.8M
	1-4g	RESERVED ¹		
FY '01	1-4g, 1-1j	RESERVED ¹		
	1-4a	Maintain project control system.	Continue	\$1.8M
FY '02	1-1k	Continue removal of all fuel and sludge from K-East and K-West basins (including stabilization and placement into interim storage).	Continue	\$30M
	1-4a	Maintain project control system.	Continue	\$1.8M
FY'03	1-1k	Complete removal of all fuel and sludge from K-East and K-West basins (including stabilization and placement into interim storage).	12/02	\$20M
	1-4a	Maintain project control system.	Continue	\$1.8M

Note: 1 Activities will be included in Phase III of this report.

APPENDIX D
Vulnerability Listing with Action Plan Development Status

VULNERABILITY LISTING WITH ACTION PLAN DEVELOPMENT STATUS

Phase II

Site/Facility Vulnerability Number Brief Verbal Description	PRIORITY			STATUS	
	Eight Major Facilities With Vulnerabilities	Less than One Year	Greater than One Year	Complete	Partial
Brookhaven/HFBR BNL-1 Unevaluated seismic resistance of spent fuel and racks.			✓		✓
Hanford/K-East Basin HAN-1-1 Corrosion of Fuel in Unsealed Canisters, and Its Release, with Fission Products into KE-Basin Environment.	✓			✓	
Hanford/K-East Basin HAN-1-2 Worker Exposures and Releases to the Environment During Re-Encapsulation of Corroding Fuel in KE-Basin.	✓			✓	
Hanford/KE & KW Basins HAN-1-3 Basin Leakage Due to Deterioration and Seismic Inadequacy of KE and KW Basin Discharge Chute Construction Joint.	✓			✓	
Hanford/KE/KW Basins HAN-1-4 The Institutional Control of Stored RINM is a Concern at K-Basins.	✓				✓
Hanford 100 Area/105 K-East Basin HAN-1-5 Plutonium-239 Accumulation in the Sand Filter Backwash Pit of 105 K-East Basin Resulted in a USQ.	✓			✓	
Hanford/KE-Basin HAN-1-6 Creation of TRU Waste Associated with the KE-Basin Operations.	✓			✓	
Hanford/KE-Basin HAN-1-7 Tritium is Evident in Monitoring Wells Near the K-Basins.	✓				✓
Hanford/KW and KE Basins HAN-1-8 Uncharacterized Fuel Stored in Sealed and Unsealed Canisters in KW and KE-Basins.	✓			✓	
Hanford/PNL 327 HAN-2-1 Uncharacterized Mixed Fission Product Accumulation in the Hot Cell Ducts in the PNL 327 Building (Hot Cells D, F, SERF).		✓			✓
Hanford/PNL 327 HAN-2-2 Isolation of Radioactive Liquid Waste (RLW) System in Building PNL-327 Due to Inability to Send RLW to the 300 Area RLW Collection Building (Bldg. 340)		✓		✓	

Site/Facility Vulnerability Number Brief Verbal Description	PRIORITY			STATUS	
	Eight Major Facilities With Vulnerabilities	Less than One Year	Greater than One Year	Complete	Partial
Hanford/PNL 324 HAN-2-3 Significant Quantities Materials (HAZMAT)/Special Case Wastes Temporarily Stored (Co-Located with RINM) in Hot Cells in Building PNL-324.			✓		✓
Hanford/PNL 324 HAN-2-4 Unresolved USQ from 1986 Radioactive Spill which Occurred in Building PNL-324, B Cell.		✓		✓	
Hanford/PNL 324/325/327 HAN-2-5 Lack of Approved Disposal Pathway for RINM Causing a Backlog of RINM at all 3 Hot Cell Facilities at PNL (Building 324/325/327).		✓			✓
Hanford/PNL 324 HAN-2-6 Lack of an Approved Integrated Facility SAR for Building 324 Radiochemical Engineering Cells (REC) and Shielded Material Facilities (SMF).		✓			✓
Hanford/PNL Building 325 HAN-2-7 Lack of an Approved Integrated Facility SAR for Building 325 High-Level Radiochemistry Facility (HLRF) and Shielded Analytical Laboratory (SAL).		✓			✓
Hanford/Building 327 HAN-2-8 Lack of an Updated Integrated Facility SAR for the PNL Building 327 Postirradiation Testing Laboratory.		✓			✓
Hanford/Building 327 HAN-2-9 Lack of a Current Seismic Analysis Building 327.		✓		✓	
Hanford/FFTF HAN-3-1 Potential for Inadequate Funding for Removal and Interim Storage of FFTF Spent Fuel.			✓	✓	
Hanford/308 Bldg Annex HAN-3-2 Inadequate Technical Safety Requirements for Storage of TRIGA Fuel in the 308 Building Annex.		✓		✓	
Hanford/308 Bldg Annex HAN-3-3 Transport/Storage Casks for Removing the Irradiated Fuel from the NRF TRIGA Storage Basin in the 308 Building Annex Have Not Been Designed or Procured.			✓	✓	

Site/Facility Vulnerability Number Brief Verbal Description	PRIORITY			STATUS	
	Eight Major Facilities With Vulnerabilities	Less than One Year	Greater than One Year	Complete	Partial
Hanford/200 West Burial Grounds HAN-4-01 EBR-II Waste Containers May Exceed Expected 25 Year Life Analyzed in the SAR of the 200 W Burial Ground.	✓			✓	
Hanford/200 West Burial Grounds HAN-4-02 Containers, Other Than EBR-II Casks, Are Not Analyzed in the SARs for Fuel Storage Containers in the 200W Burial Grounds.	✓			✓	
Hanford/Burial Grounds HAN-4-03 The Inventory of RINM Cannot Be Determined or Verified at the Hanford Burial Grounds or in Basins at F- and H-Reactors.	✓			✓	
Hanford/200 West Burial Grounds HAN-4-04 Fuel Stored on Interim Basis in Burial Ground May Exceed Expected Storage Period in the 200 Area Burial Grounds.	✓			✓	
Hanford/T-Plant HAN-4-05 Susceptibility of the T-Plant Fuel Pool to Seismic Damage.		✓			✓
Hanford/T-Plant HAN-4-06 Lack of Forward Path for Removal and Ultimate Disposition of the Fuel Currently Stored in the T-Plant Spent Fuel Pool.		✓		✓	
Hanford/T-Plant HAN-4-07 Poor Housekeeping in the T-Plant Canyon.		✓		✓	
Hanford/T-Plant Canyon HAN-4-08 T-Plant Fuel Pool Cooling System Pump not Qualified for Current Environmental Service Conditions.		✓		✓	
Hanford/PUREX - HAN-4-09 Frequency of Fuel Pool Level Monitoring at PUREX.	✓			✓	
Hanford/PUREX HAN-4-10 Inaccessibility of Fuel for Inspection at PUREX.	✓			✓	
Hanford/PUREX HAN-4-11 The Four Fuel Baskets are Only Supported from One Rail at the PUREX Fuel Pool.	✓			✓	
Hanford/PUREX HAN-4-12 Fuel, Fuel Baskets, and Yoke Assemblies are Corroded at PUREX Fuel Pool.	✓			✓	

Site/Facility Vulnerability Number Brief Verbal Description	PRIORITY			STATUS	
	Eight Major Facilities With Vulnerabilities	Less than One Year	Greater than One Year	Complete	Partial
Hanford/PUREX HAN-4-13 N-Reactor Fuel Elements, Both Intact and Broken, Located on Dissolver Cell Floors at PUREX.	✓			✓	
Hanford/PUREX HAN-4-14 No Path Forward for Ultimate Disposal of Fuel Stored at PUREX.	✓			✓	
Hanford/Site-wide HAN-S-1 Sitewide Classification of DOE Spent Nuclear Fuel (SNF) and Spent Nuclear Material (SNM) Materials as Hazardous Waste.	✓			✓	
Hanford/200 West Burial Grounds HAN-S-2 Classification of RINM is Undetermined in the 200 Area Burial Grounds.	✓			✓	
INEL/Hot Fuels Exam. Facility at ANL-West ID.A.1.1 Lack of an approved SAR for Hot Fuels Examination Facility (HFEF).		✓			✓
INEL/RSWF ID.A.2.1 Corrosion of in-ground carbon steel fuel storage containers at RSWF - ANL West.			✓	✓	
INEL/Zero Power Physics Reactor ID.A.5.1 Potential localized radioactive releases from cladding separation from fuels stored in ZPPR storage vault.			✓	✓	
INEL/Zero Power Physics Reactor ID.A.5.2 Lack of approved path forward for ultimate disposal of ZPPR fuel stored in ZPPR storage vault.			✓		✓
INEL/Test Area North ID.E.1.1 Corrosion monitoring inadequate at TAN.		✓		✓	
INEL/Test Area North Pool ID.E.1.2 Lack of Leak Detection and Leak Trending of Test Area North (TAN) Storage Pool Water Inventory.			✓		✓
INEL/Test Area North Pool ID.E.1.3 Long Term Ownership of TAN Pool and Disposition of Residual RINM Inventory.			✓	✓	
INEL/Test Area North/TAN 607-Basin ID.E.1.4 Potential Deficiency in Seismic Design of TAN 607 Basin.			✓	✓	